Chapter 07

Project Cost Management

erga

Project Management

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Erga Academy

PM17 – PMP6 Certification

EPDM & ESM tracks

20 credits

Plan


1. Introduction
2. Environment in which projects operate
3. The role of the Project Manager
4. Project Integration Management
5. Project Scope Management
6. Project Schedule Management
7. Project Cost Management
8. Project Quality Management
9. Project Resource Management
10. Project Communications Management
11. Project Risk Management
12. Project Procurement Management
13. Project Stakeholder Management
14. Professional Responsibility

Plan

- Chapter 07- Project Cost Management

It includes the processes involved in planning, estimating, budgeting, financing, funding, managing and controlling costs so that the project can be completed within the approved budget.

Plan

- Chapter 07- Project Cost Management

  7.1 Plan Cost Management

  7.2 Estimate Costs

  7.3 Determine Budget

  7.4 Control Costs

	Project Management Process Groups				
Knowledge Areas	Initiating	Planning	Executing	Monitoring & Controlling	Closing
7. Project Cost Management		7.1 Plan Cost Management 7.2 Estimate Costs 7.3 Determine Budget		7.4 Control Costs	

Plan

Chapter 07- Project Cost Management

- **7.1 Plan cost management** (*planning*): The process that establishes the policies, procedures and documentation for planning, managing, expending & controlling project costs.

- **7.2 Estimate Costs** (*planning*): The process of developing an approximation or estimate the costs for the resources needed to complete the project activities.

- **7.3 Determine Budget** (*planning*): The process of aggregating the estimated costs of individual activities or work packages to establish an authorized cost baseline.

- **7.4 Control Costs** (*M&C*) : the process of monitoring the status of the project budget and managing changes to the cost baseline.

Chapter 07- Project Cost Management

- Project Cost Management is primarily concerned with the cost of the resources needed to complete project activities. Project Cost Management should consider the effect of project decisions on the subsequent recurring cost of using, maintaining, and supporting the product, service, or result of the project.

- Another aspect of cost management is recognizing that different stakeholders measure project costs in different ways and at different times.

Chapter 07- Project Cost Management

Trends include the expansion of earned value management (EVM) to include the concept of earned schedule (ES).

ES is an extension to the theory and practice of EVM. Earned schedule theory replaces the schedule variance SV measures used in traditional EVM (earned value − planned value) with ES and actual time (AT). Using the alternate equation for calculating schedule variance ES − AT, if the amount of earned schedule is greater than 0, then the project is considered ahead of schedule. In other words, the project earned more than planned at a given point in time. The schedule performance index (SPI) using earned schedule metrics is ES/AT. This indicates the efficiency with which work is being accomplished. Earned schedule theory also provides formulas for forecasting the project completion date, using earned schedule, actual time, and estimated duration.

Chapter 07- Project Cost Management

Considerations for tailoring include:

- **Knowledge management**. Does the organization have a formal knowledge management and financial database repository that a project manager is required to use and that is readily accessible?
- **Estimating and budgeting.** Does the organization have existing formal or informal cost estimating and budgeting-related policies, procedures, and guidelines?
- **Earned value management.** Does the organization use earned value management in managing projects?
- **Use of agile approach**. Does the organization use agile methodologies in managing projects? How does this impact cost estimating?
- **Governance.** Does the organization have formal or informal audit and governance policies, procedures, and guidelines?

Chapter 07- Project Cost Management

Projects with high degrees of uncertainty or those where the scope is not yet fully defined may not benefit from detailed cost calculations due to frequent changes. Instead, lightweight estimation methods can be used to generate a fast, high-level forecast of project labor costs, which can then be easily adjusted as changes arise. Detailed estimates are reserved for short-term planning horizons in a just-in-time fashion.

- In cases where high-variability projects are also subject to strict budgets, the scope and schedule are more often adjusted to stay within cost constraints.

Basic Principles of Cost Management

Most members of a executive board better understand and are more interested in financial terms, so PMs must speak their language

Profits are **revenues** minus expenditures	**Life cycle costing** considers the total cost of ownership, or development plus support cost, for a project	**Cash flow analysis** determines the estimated annual costs and benefits for a project and the resulting annual cash flow (inflow versus outflow)

Chapter 07- Project Cost Management

Basic Principles of Cost Management (cont'd)

- Learning curve theory states that when many items are produced repetitively, the unit cost of those items decreases in a regular pattern as more units are produced.
- "Contingency reserves" are used for known risks & "Management reserves" are used for unknown risks.
- Direct costs are costs that can be directly related to producing the products and services of the project.
- Indirect costs are costs that are not directly related to the products or services of the project, and are indirectly related to performing the project.
- Sunk cost is money that has been spent in the past; It must NOT be considered in decision making for pre-mature project termination / project cancellation.

Chapter 07- Project Cost Management

Basic Principles of Cost Management (cont'd)

- ✓ **Law of diminishing return**: The more you put into something, the less you get out of it. E.g., Doubling resources won't necessarily halve the time.
- ✓ **Working capital**: The amount of money available to the company to invest in the project, as well as the day-to-day company operations.
- ✓ **Funding limit reconciliation**: Comparing the planned expenditure on a project with the committed (available) funds during a given period.

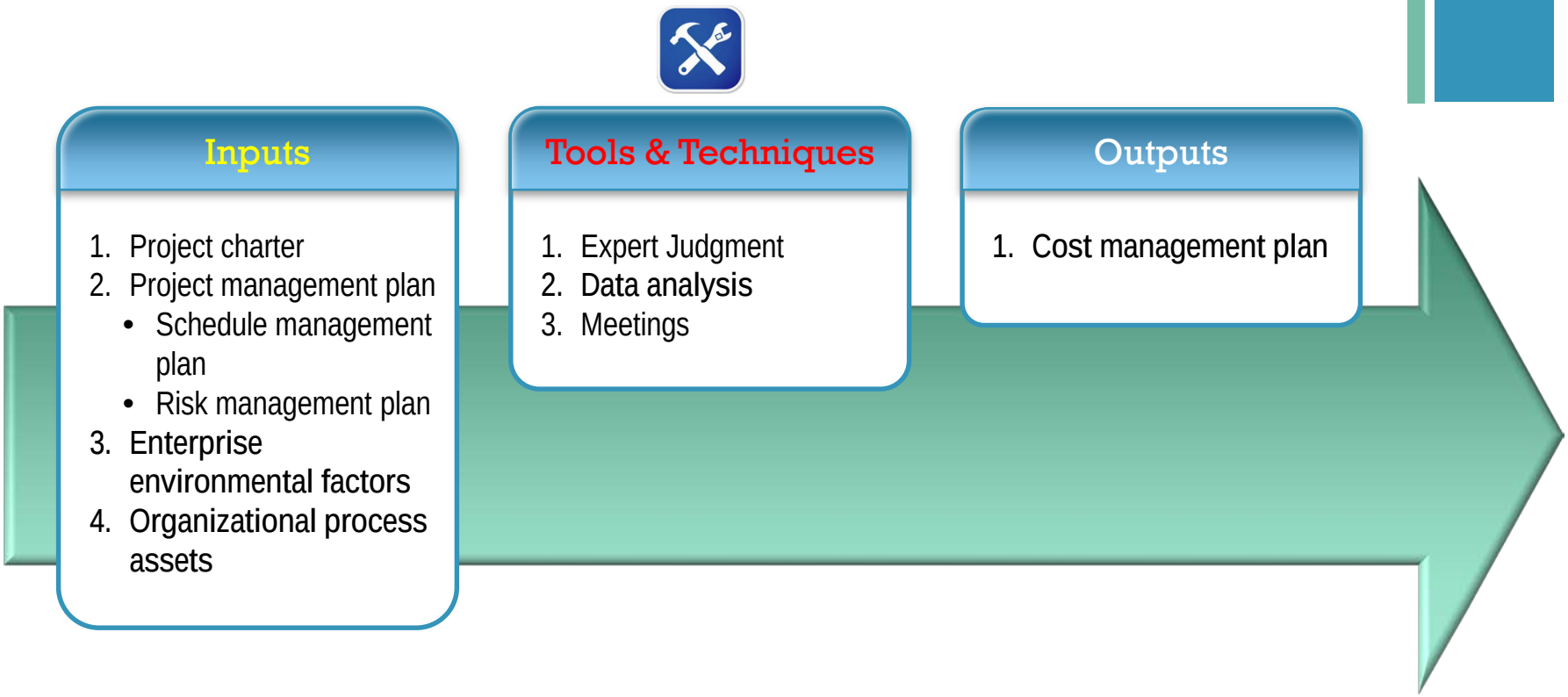
- ✓ **Depreciation**: Large assets purchased by the company lose value over time. There are two forms of depreciation:
  - **Straight line depreciation**: The same amount of depreciation is provided for every year, so a car with a price tag of $10,000 and a useful life of 10 years, is depreciated by $1,000 per year.
  - **Accelerated depreciation**: The asset depreciates faster than the straight line depreciation, so a car with a price tag of $10,000 depreciates $3,000 the first year, $1,500 next year, $1,000 the third year, and so on.

7.1 Plan Cost Management

Defining how the project costs will be estimated, budgeted, managed, monitored, and controlled.

- Define the approach on how the project COST will be structured and controlled.
- All the cost management PROCESSES and their associated tools and techniques are documented.

7.1 Plan Cost Management



7.1 Plan Cost Management

3. Enterprise environmental factors

Include but are not limited to:

- Organizational culture and structure can influence cost management.
- Market conditions describe what products, services, and results are available in the regional and global markets.
- Currency exchange rates for project costs are sourced from more than one country.
- Published commercial information such as resource cost rate information is often available from commercial databases that track skills and human resource costs, and provide standard costs for material and equipment. Published seller price lists are another source of information.
- PMIS provides alternative possibilities for managing cost.
- Productivity differences in different parts of the world can have a large influence on the cost of projects.

7.1 Plan Cost Management

4. Organizational process assets

Include but are not limited to:

- Financial controls procedures (time reporting, required expenditure and disbursement reviews, accounting codes, and standard contract provisions);
- Historical information and lessons learned repository;
- Financial databases;
- Existing formal and informal cost estimating and budgeting-related policies, procedures, and guidelines.

7.1 Plan Cost Management

2. Data analysis

A data analysis technique that can be used for this process includes but is not limited to ***alternatives analysis***. Alternatives analysis can include reviewing strategic funding options such as: self-funding, funding with equity, or funding with debt. It can also include consideration of ways to acquire project resources such as making, purchasing, renting, or leasing.

* Business owners can utilize a variety of financing resources, initially broken into two categories, debt and equity. "Debt" involves borrowing money to be repaid, plus interest, while "equity" involves raising money by selling interests in the company.

7.1 Plan Cost Management

1. Cost Management Plan

"Cost Management Plan" is created as part of the *develop project management plan* process in integration management.

- The cost management plan answers the following:
  - "How will I go about planning cost for the project?"
  - "How will I effectively manage the project to the cost baseline and manage cost variances?"

- This management plan is similar to other management plans and it can be formal or informal, but it is part of PMP

7.1 Plan Cost Management

1. Cost Management Plan (cont'd)

The cost management Plan includes:

- ✓ **Units of measure**. Each unit used in measurements (such as staff hours, staff days, or weeks for time measures; meters, liters, tons, kilometers, or cubic yards for quantity measures; or lump sum in currency form) is defined for each of the resources.
- ✓ **Organizational procedures links**. The WBS provides the framework for the cost management plan, allowing for consistency with the estimates, budgets, and control of costs. The WBS component used for the project cost accounting is called the control account. Each control account is assigned a unique code or account number(s) that links directly to the performing organization's accounting system.

7.1 Plan Cost Management

1. Cost Management Plan (cont'd)

- ✓ **Control thresholds**. Variance thresholds for monitoring cost performance may be specified to indicate an agreed-upon amount of variation to be allowed before some action needs to be taken. Thresholds are typically expressed as (%) deviations from the baseline plan.
- ✓ **Rules of performance measurement**. Earned value management (EVM) rules of performance measurement are set. For example, the cost management plan may:
  - Define the points in the WBS at which measurement of control accounts will be performed;
  - Establish the EVM techniques (weighted milestones, fixed-formula, percent complete, etc.) to be employed;
  - Specify tracking methodologies and the EVM computation equations for calculating projected estimate at completion (EAC) forecasts to provide a validity check on the bottom-up EAC.

7.1 Plan Cost Management

1. Cost Management Plan (cont'd)

- ✓ **Level of precision**. This is the degree to which cost estimates will be rounded up or down (US$995.59 to US$1,000), based on the scope of the activities and magnitude of the project.
- ✓ **Level of accuracy**. The acceptable range (±10%) used in determining realistic cost estimates is specified, and may include an amount for contingencies.
- ✓ **Reporting formats**. The formats and frequency for the various cost reports are defined.
- ✓ **Additional details**. Additional details about cost management activities include:
  - Description of strategic funding choices,
  - Procedure to account for fluctuations in currency exchange rates,
  - Procedure for project cost recording.

7.2 Estimate Costs

Developing an approximation of the monetary resources needed to complete project activities.

- Predictions are based on timely known information.
- Quantitative assessment of the resources cost.
- Cost trade-off and risks are considered.
- The person or group doing the estimation must consider the possible fluctuations, conditions, and other causes of variances that could affect the total cost of the estimate.
- Iterative process: Estimation getting more accurate as project progresses. (at initiation phase, the estimate could have a Rough Order of Magnitude (ROM) of +75/-25%

7.2 Estimate Costs

Cost Estimates accuracy

"Rough order of magnitude (ROM)" This estimate is "rough" and is used during the initiating processes and in top-down estimates. The range of variance for the estimate can be from −25% to +75%.

"Budget estimate" This estimate is also somewhat broad and is used early in the planning processes and also in top-down estimates. The range of variance for the estimate can be from −10% to +25%.

"Definitive estimates" This estimate type is one of the most accurate. It's used late in the planning processes and is associated with bottom-up estimating. The range of variance for the estimate can be from −5% to +10%.

7.2 Estimate Costs

Cost Estimating

What is estimated? All the work needed to complete the project including:

- ✓ Quality efforts;
- ✓ Risk efforts;
- ✓ The PM's time;
- ✓ Cost of project management activities;
- ✓ Costs directly associated with the project, including training for the project, paper, pencils, needed labor;
- ✓ Office expenses for offices used directly for the project;
- ✓ Overhead, such as management salaries, general office expenses.

7.2 Estimate Costs

Types of Cost:

- **Direct costs:** These costs are attributed directly to the project work and cannot be shared among projects (ex: resource cost, airfare, hotels, and long distance phone charges, and so on).

- **Indirect costs:** These are overhead items or costs incurred for the benefits of more than one project (ex: taxes, fringe benefits: an extra benefit supplementing an employee's money wage or salary, for example a company car, private health care, etc.).

- **Variable costs:** These costs change with the amount of production (or) the amount of work (ex. Cost of material, supplies, wages).

- **Fixed costs:** These costs remain constant throughout the project (the cost of a piece of rented equipment, the cost of a consultant brought onto the project).

7.2 Estimate Costs

❖ Opportunity Costs

The opportunity given up by selecting one project over another.

You have two projects to choose from; Project A with an NPV of $45,000 or Project B with an NPV of $8,000.
What is the opportunity cost of selecting project B?
Answer $45,000.

7.2 Estimate Costs

Inputs

1. Project management plan
   - Cost management plan
   - Quality management plan
   - Scope baseline
2. Project documents
   - Lessons learned register
   - Project schedule
   - Resources requirements
   - Risk register
3. Enterprise environmental factors
4. Organizations process assets

Tools & Techniques

1. Expert judgment
2. Analogous estimating
3. Parametric estimating
4. Bottom-up estimating
5. Three-point estimating
6. Data analysis
   - Alternatives analysis
   - Reserve analysis
   - Cost of quality
7. Project management information system
8. Decision making
   - Voting

Outputs

1. Cost estimates
2. Basis of estimates
3. Project documents updates
   - Assumption log
   - Lessons learned register
   - Risk register

7.2 Estimate Costs

3. Enterprise Environmental Factor

- **Market conditions**. These conditions describe what products, services, and results are available in the market, from whom, and under what terms and conditions. Regional and/or global supply and demand conditions greatly influence resource costs.
- **Published commercial information**. Resource cost rate information is often available from commercial databases that track skills and human resource costs, and provide standard costs for material and equipment. Published seller price lists are another source of information.
- **Exchange rates and inflation**. For large-scale projects that extend multiple years with multiple currencies, the fluctuations of currencies and inflation need to be understood and built into the *Estimate Cost* process.

7.2 Estimate Costs

1. Expert Judgment

Expert judgment, guided by historical information, provides valuable insight about the environment and information from previous similar projects.

2. Analogous Estimating

- Analogous estimating relies on historical information & expert judgment. It is also known as *top-down estimating*.
- The process of analogous estimating takes the actual cost of a historical project as a basis for the current project.

3. Parametric Estimating

- Estimation based on a set "Parameter"
- Estimation done based on historical records from previous projects & other available information.
- Example: Time per installation, cost per sq. feet

7.2 Estimate Costs

6. Data analysis

- **Alternative analysis**

  Alternatives analysis is a technique used to evaluate identified options in order to select which options or approaches to use to execute and perform the work of the project. An example would be evaluating the cost, schedule, resource, and quality impacts of buying versus making a deliverable.

- **Cost of Quality**

  Assumptions about costs of quality may be used to prepare the estimates. This includes evaluating the cost impact of additional investment in conformance versus the cost of nonconformance. It can also include looking at short-term cost reductions versus the implication of more frequent problems later on in the product life cycle.

7.2 Estimate Costs

6. Data analysis (cont'd)

- **Reserve Analysis**

  Cost estimates may include contingency reserves (or contingency allowances) to account for cost uncertainty. Contingency reserves are the budget within the cost baseline that is allocated for identified risks. Contingency reserves are often viewed as the part of the budget intended to address the known-unknowns that can affect a project.

  - The contingency reserve may be a percentage of the estimated cost, a fixed number, or may be developed by using quantitative analysis methods.

  As more precise information about the project becomes available, the contingency reserve may be used, reduced, or eliminated. Contingency should be clearly identified in cost documentation. They are part of the cost baseline and the overall funding requirements for the project.

7.2 Estimate Costs

7. Project Management Estimating Software

- The (PMIS) can include spreadsheets, simulation software, and statistical analysis tools to assist with cost estimating. Such tools simplify the use of some cost-estimating techniques and thereby facilitate rapid consideration of cost estimate alternatives.

7.2 Estimate Costs

1. Cost Estimates

The output of cost estimating is the actual cost estimates of the resources required to complete the project work.

- Each resource in the project must be accounted for and assigned to a cost category. Categories include the following:
  - Labor costs
  - Material costs
  - Travel costs
  - Supplies
  - Hardware costs
  - Software costs
  - Special categories (inflation, cost reserve, and so on)
- Cost estimates can also pass through progress elaboration.
- As more details are acquired as the project progresses, the estimates are refined.

7.2 Estimate Costs

2. Basis of estimates

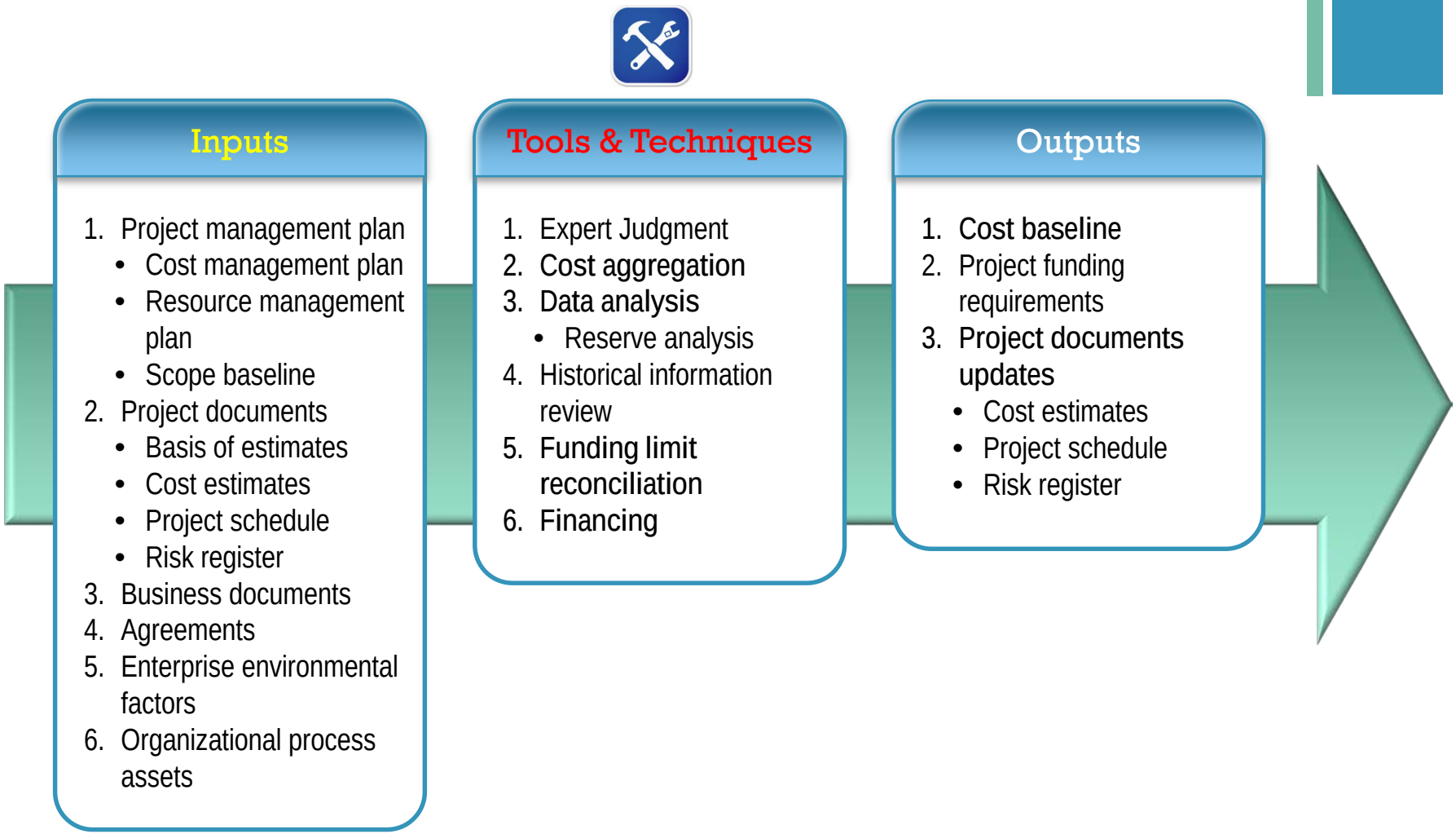
- Once the estimates have been completed, supporting detail must be organized and documented to show how the estimates were created.
- Specifically, the supporting detail includes the following:
  - Documentation of the basis of the estimate (how it was developed),
  - Documentation of all assumptions made,
  - Documentation of any known constraints,
  - Documentation of identified risks included when estimating costs,
  - Indication of the range of possible estimates (US$10,000 (±10%) to indicate that the item is expected to cost between a range of values),
  - Indication of the confidence level of the final estimate.

7.3 Determine Budget

Aggregating the estimated costs of individual activities or work packages to establish an authorized cost baseline.

- The budgeted cost will be used to measure the project's progress and performance
- Remember that costs are tied to the financial system through the "control accounts" in work package level of the WBS.
- The budget will be used for allocating costs to project activities.

7.3 Determine Budget



7.3 Determine Budget

2. Cost Aggregation

Costs are rolled up to work package costs. Work package costs are rolled up to measure the project's overall budget.

3. Data analysis

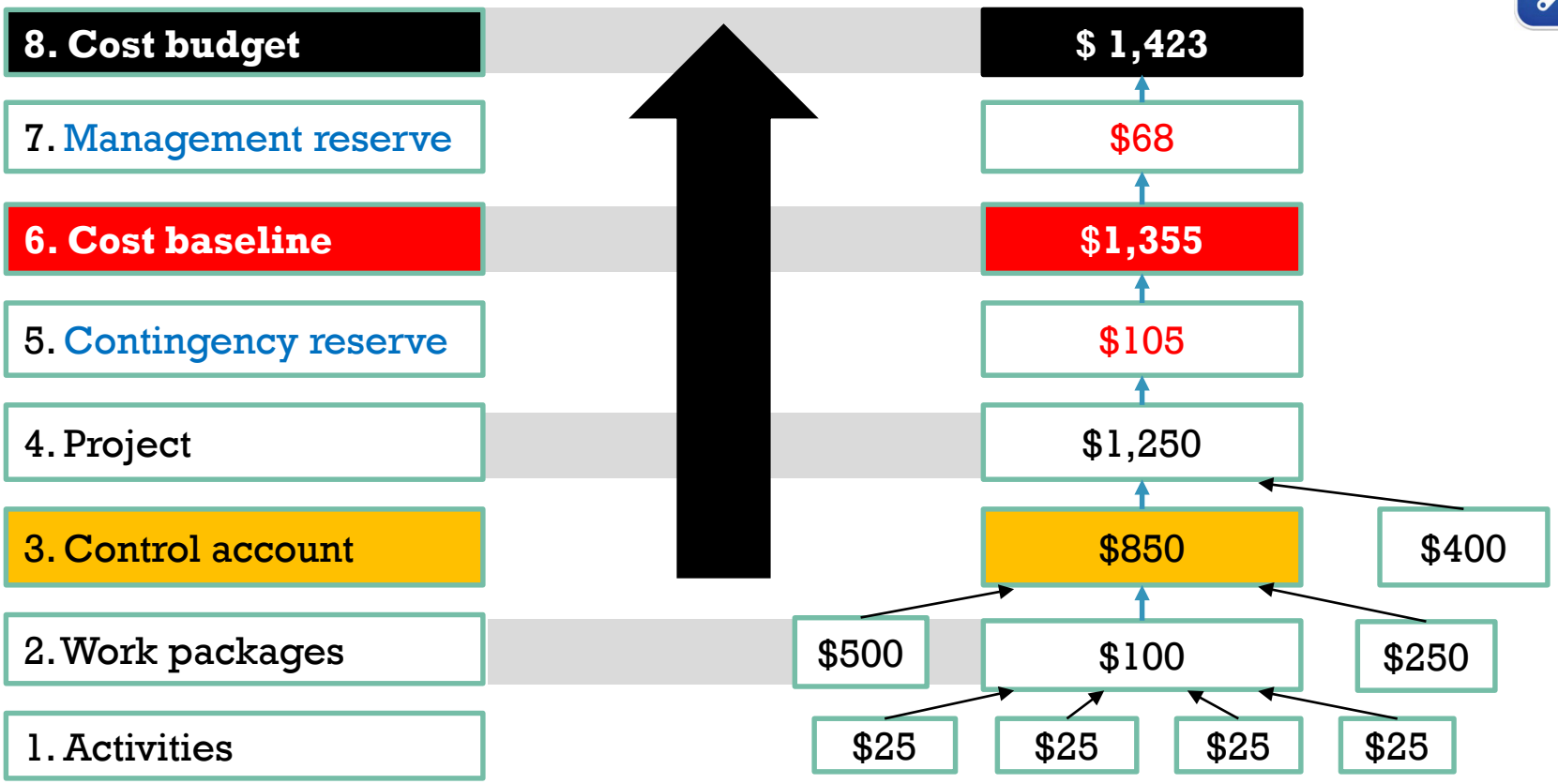
Reserve Analysis

- Contingency Reserves.
- Management Reserves.

7.3 Determine Budget

Input → Tools & Techniques → Output

3. Data analysis



7.3 Determine Budget

5. Funding Limit Reconciliation

- The expenditure of funds should be reconciled with any funding limits on the commitment of funds in the project.
- Funding limit reconciliation is an organization's approach to manage cash flow against the project deliverables based on a schedule, milestone accomplishment or data constraints.
- This helps an organization plan when funds will be devoted to a project rather than using all of the funds available at the start of a project.

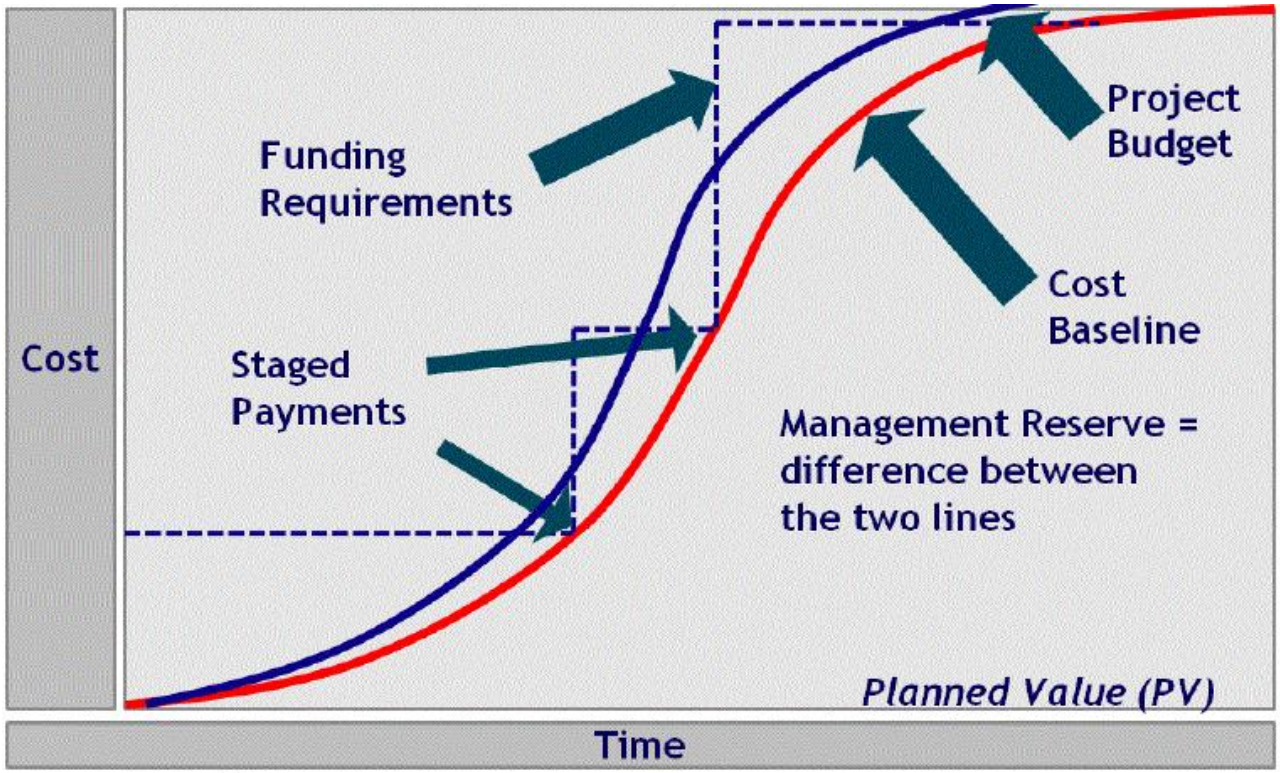
6. Financing

- Financing entails acquiring funding for projects. It is common for long-term infrastructure, industrial, and public services projects to seek external sources of funds. If a project is funded externally, the funding entity may have certain requirements that are required to be met.

7.3 Determine Budget

1. Cost Baseline

A project's cost baseline shows what is expected to be spent on the project. It's usually shown in an S-curve.



7.3 Determine Budget

1. Cost Baseline (cont'd)

- The idea of the cost baseline allows the PM and management to predict when the project will be spending monies and over what time period.
- Large projects that have multiple deliverables may have multiple cost baselines to illustrate the costs within each phase.
- The purpose of a cost baseline is to measure performance, and a baseline will predict the expenses over the life of the project.

3. Project Document Updates:

Documents that may get updated include:

- Cost estimates
- Project schedule
- Risk register

7.4 Control Costs

Monitoring the status of the project to update the project costs and managing changes to the cost baseline

- Controlling causes of change to ensure the changes are actually needed.
- Controlling and documenting changes to the cost baseline as they happen.
- Performing cost monitoring to recognize and understand cost variances.
- Preventing unauthorized changes to the cost baseline.
- Communicating the cost changes to the stakeholders.

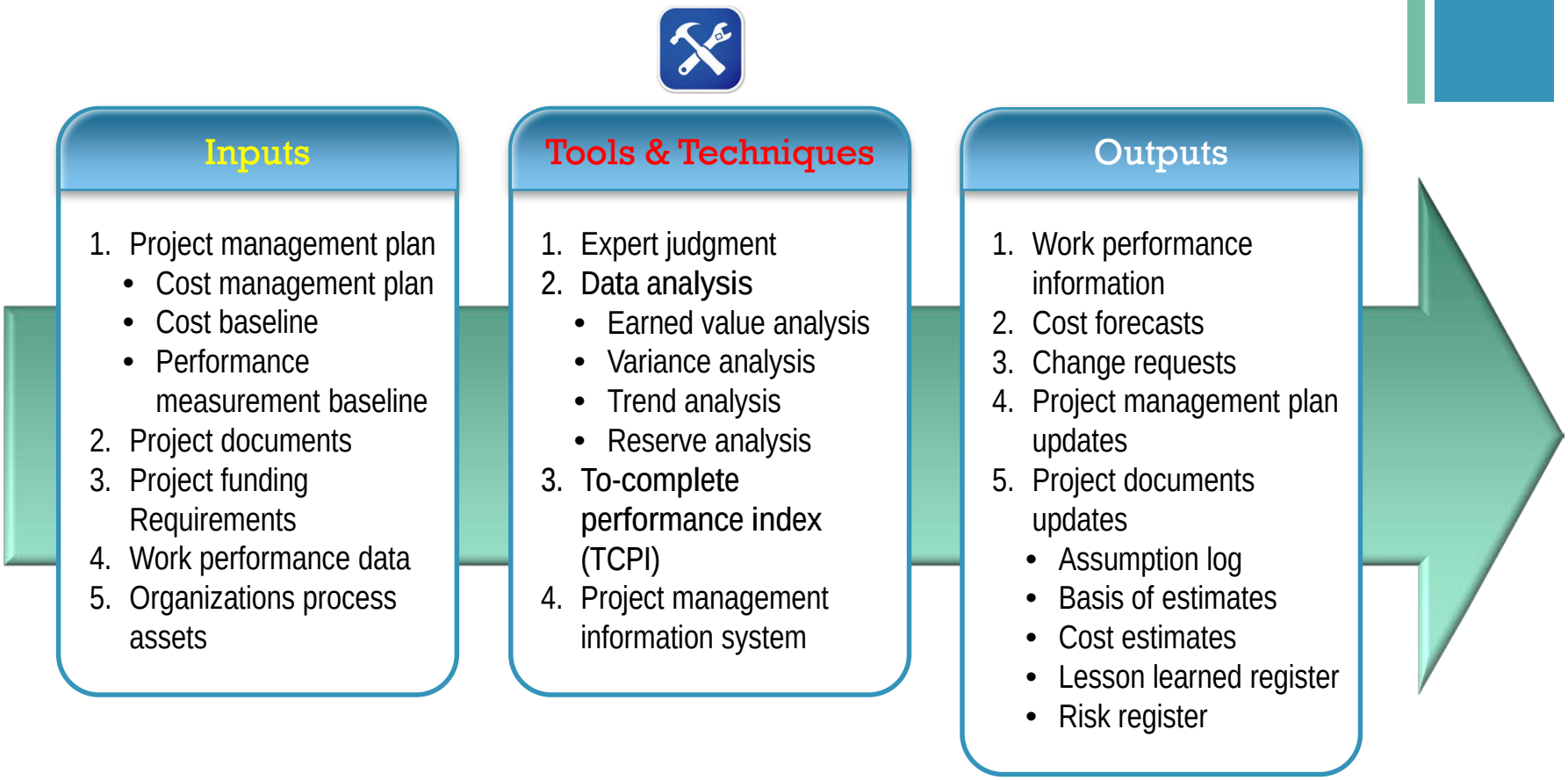
Observe and analyze the relation between **expenditures** and **work done**

Authorized budget increases can only be requested through the **Integrated Change control** Process

7.4 Control Costs

- Much of the effort of cost control involves analyzing the relationship between the consumption of project funds and the work being accomplished for such expenditures. The key to effective cost control is the management of the approved cost baseline. Project cost control includes:
  - Influencing the factors that create changes to the authorized cost baseline;
  - Ensuring that all change requests are acted on in a timely manner;
  - Managing the actual changes when and as they occur;
  - Ensuring that cost expenditures do not exceed the authorized funding by period, by WBS component, by activity, and in total for the project;
  - Monitoring cost performance to isolate and understand variances from the approved cost baseline;
  - Monitoring work performance against funds expended;
  - Preventing unapproved changes from being included in the reported cost or resource usage;
  - Informing stakeholders of all approved changes and associated cost;
  - Bringing expected cost overruns within acceptable limits.

7.4 Control Costs



7.4 Control Costs

2. Data analysis

Earned Value analysis (EVA)

Performance measurement analysis is accomplished using a technique called *earned value technique (EVT).*

- The EVT is a method to measure project performance against the project baseline.
- Results from an earned value analysis indicate potential deviation of the project from cost and schedule baselines.
- Many PMs manage their project performance by comparing planned to actual schedule alone. With this method, you could be possibly on time but you may have overspent.
- EVT is a better method because it integrates cost, time and work done (or scope) and can be used to forecast future performance and project completion dates and costs.

7.4 Control Costs

2. Data analysis

Earned Value analysis (cont'd)

It integrates Project scope, Cost and Schedule through the monitoring of:

Planned Value (PV)
The authorized budget assigned to the work activity or WBS component

Earned Value (EV)
The calculated budget authorized to accomplish the **performed** work

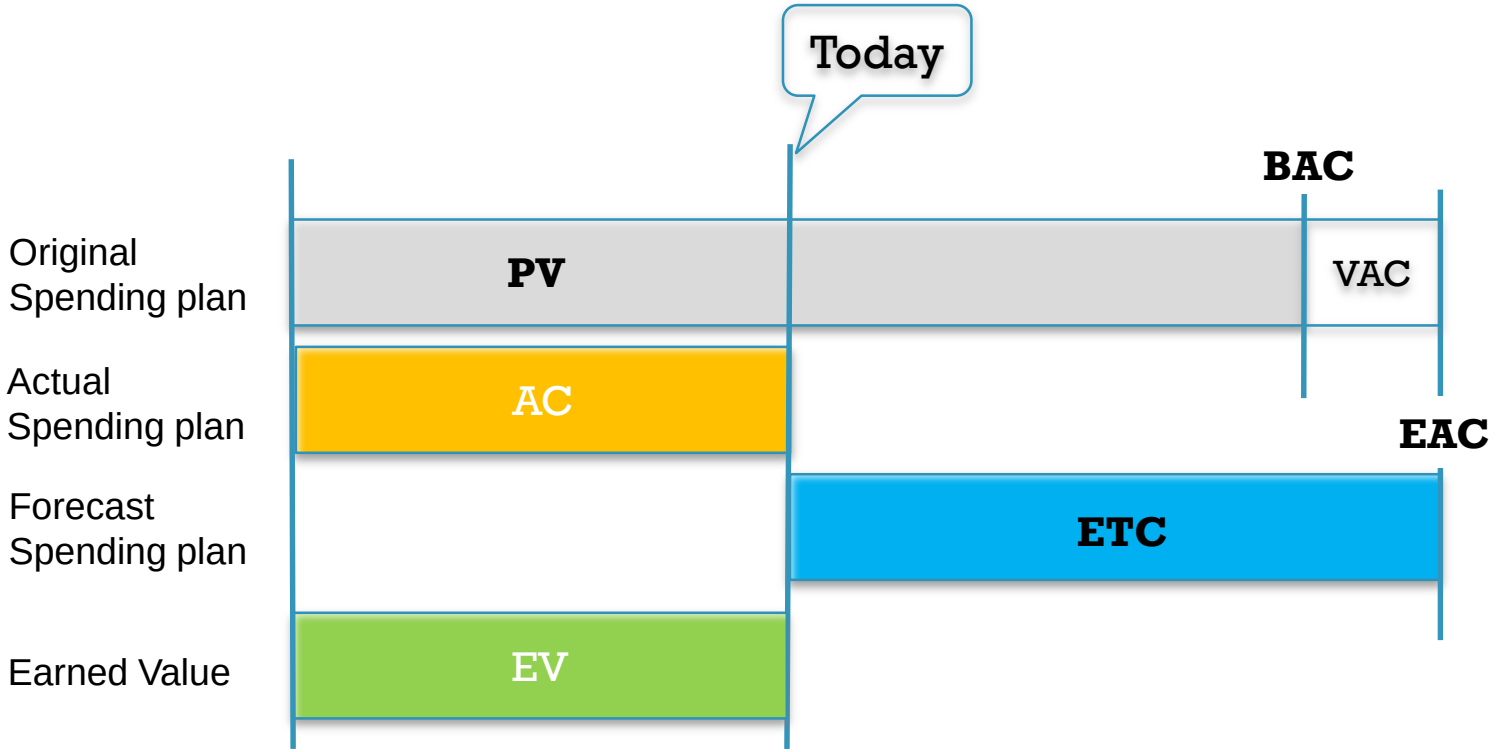
Actual Cost (AC)
The recorded real cost incurred to accomplish the **performed** work

The total PV of the project is called BAC (Budget at completion) or PMB (performance Measurement Baseline)

7.4 Control Costs

2. Data analysis

Earned Value analysis (cont'd)



7.4 Control Costs

2. Data analysis

Earned Value analysis (cont'd)

Acronym	Term	Acronym	Term
PV	Planned value	**BCWS**	Budgeted cost of work scheduled
EV	Earned value	**BCWP**	Budgeted cost of work Performed
AC	Actual cost	**ACWP**	Actual cost of work performed

7.4 Control Costs

2. Data analysis

Earned Value analysis (cont'd)

Acronym	Term	Interpretation
PV	Planned value	What is the estimated value of the work planned to be done ?
EV	Earned value	What is the estimated value of the work actually accomplished?
AC	Actual cost	What is the actual cost incurred for the work accomplished?
BAC	Budget at completion	How much did we BUDGET for the TOTAL project effort?
EAC	Estimate at completion	What do we currently expect the TOTAL project to cost?
ETC	Estimate to complete	From this point on, how much MORE do we expect it to cost to finish the project?
VAC	Variation at completion	How much over or under budget do we expect to be at the end of the project?

7.4 Control Costs

2. Data analysis

Earned Value analysis (cont'd)

Term	Formula	Interpretation
Cost variance (CV)	EV-AC	NEGATIVE is over budget; POSITIVE is under budget
Schedule Variance (SV)	EV - PV	NEGATIVE is behind schedule; POSITIVE is ahead of schedule
Cost Performance Index (CPI)	EV/AC	We are getting $ -------- worth of work out of every $1 spent. Funds are or are not being used efficiently
Schedule Performance Index (SPI)	EV/PV	We are (only) progressing at ------ percent of the rate originally planned.
Estimate At completion (EAC)	BAC/CPI	As of now, how much do we expect the total project to cost?
Estimate To Complete (ETC)	EAC - AC	How much more will the project cost?

7.4 Control Costs

2. Data analysis

Earned Value analysis (cont'd)

Term	Formula	Interpretation
Variance At Completion (VAC)	BAC-EAC	How much over or under budget do we expect to be at the end of the project?
To Complete Performance Index (TCPI)	If BAC is still viable: (BAC-EV)/(BAC-AC) If BAC is not viable: (BAC-EV)/(EAC-AC)	This formula divides the work remaining to do by the money remaining to do it. It answers the question of "In order to stay within budget, what rate must we meet for the remaining work?"

The **Total Point of Assumption** is when the Actual costs equal the project budget

7.4 Control Costs

Input → Tools & Techniques → Output

2. Data analysis

Variance analysis

The variances from the approved baselines will be measured using the following formulas:

Schedule Variance (SV)

The SV measures the schedule performance on the project

SV = EV - PV

SV =0 Project on schedule
SV >0 Project ahead of schedule
SV <0 Project behind of schedule

Cost Variance (CV)

The CV measures the cost performance on the project

CV = EV - AC

CV =0 Project on Budget
CV >0 Project under Budget
CV <0 Project Over Budget

7.4 Control Costs

2. Data analysis

Variance analysis (cont'd)

The variances from the approved baselines (SV & CV) can be converted to Schedule and Cost performance INDICATORS:

Schedule Performance Index (SPI)

The SPI measures the Value of work achieved to the value planned

SPI = EV / PV

SPI =1 Project on schedule
SPI >1Project ahead of schedule
SPI <1 Project behind of schedule

Cost Performance Index (CPI)

The CV measures the value of work achieved to the actual cost incurred

CPI = EV / AC

CPI =1 Project on Budget
CPI >1 Project under Budget
CPI <1 Project Over Budget

7.4 Control Costs

2. Data analysis

Trend analysis - Forecasting

When schedule and cost variances become important, The BAC (Budget at completion) become no longer viable

In this case the project team develops a forecast based on the incurred Actual Cost (AC) plus the remaining work Estimate to complete (ETC)

Estimate At Completion EAC = AC + Sum(ETCs of remaining work)

7.4 Control Costs

2. Data analysis

Trend analysis - Forecasting (cont'd)

Common EAC calculation methods (**EAC = AC + ETC**)

ETC future cost based on the planned rates	ETC future cost based on the current performance of the project (CPI)	ETC future cost based on both performance CPI & SPI indexes
EAC = AC + (BAC – EV) **EAC = AC + ETC**	**EAC = BAC / (∑ CPI)**	**EAC = AC + (BAC – EV) / (∑ CPI * ∑ SPI)**
In this case ETC = BAC - EV	In this case ETC = (BAC – EV) / ∑ CPI	Variations of this method can be applied by multiplying CPI &/or SPI by a weight factor between 0 & 1

7.4 Control Costs

2. Data analysis

Trend analysis – Forecasting models

Causal/Econometric forecast

Causal methods are based on the ability to identify variables that may cause or influence the forecast. The methods included in this category are:

- Regression analysis - Linear, non-linear
- autoregressive moving average
- econometrics

Time series

This forecasting method uses historical data to predict future performance:

- Earned Value
- Moving average
- Extrapolation
- Linear prediction
- Trend estimation
- Growth curve

Other methods

Other types of forecasting methods include

- simulation (like Monte Carlo analysis),
- probabilistic forecasting,
- ensemble forecasting

Judgmental

This category of forecasting uses opinions, intuitive judgments, and probability estimates to determine possible future results. Methods within this category include

- Surveys
- Composite forecasts
- Delphi method
- Scenario building
- Technology forecasting
- Forecast by analogy

7.4 Control Costs

2. Data analysis

Trend analysis – Charts

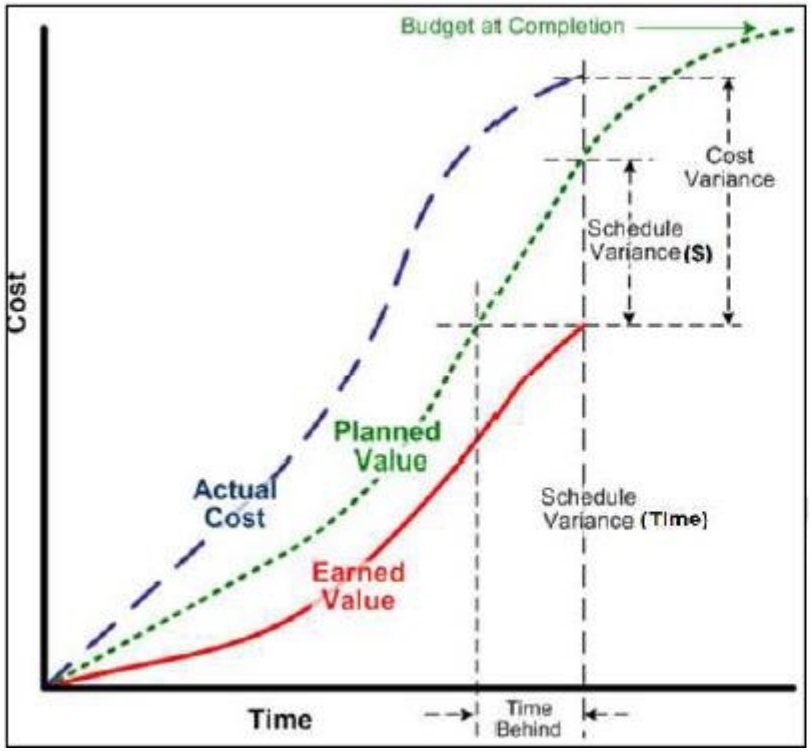
In earned value analysis, PV, EV and AC can be monitored and reported on both a period-by period basis (typically weekly or monthly) and on a cumulative basis. The following charts uses S-curves to display EV data for a project that is performing over budget and behind the schedule…

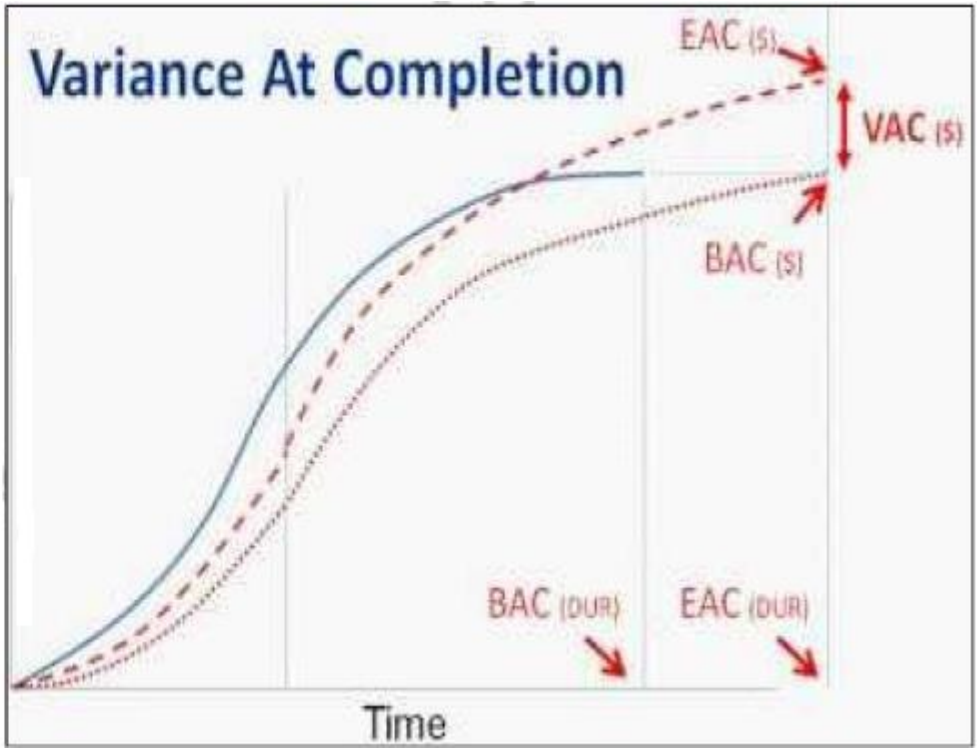
7.4 Control Costs

Input → Tools & Techniques → Output

2. Data analysis

Trend analysis – Charts (cont'd)





7.4 Control Costs

2. Data analysis

Reserve analysis

During cost control, reserve analysis is used to monitor the status of contingency and management reserves for the project to determine if these reserves are still needed or if additional reserves need to be requested. As work on the project progresses, these reserves may be used as planned to cover the cost of risk responses or other contingencies. Conversely, when opportunities are captured and resulting in cost savings, funds may be added to the contingency amount, or taken from the project as margin/profit.

- If the identified risks do not occur, the unused contingency reserves may be removed from the project budget to free up resources for other projects or operations.
- Additional risk analysis during the project may reveal a need to request that additional reserves be added to the project budget.

7.4 Control Costs

3. To-Complete Performance Index

The To-Complete performance index **TCPI** is the projection until the completion of the project, of the cost performance index:

TCPI = (BAC – EV) / (BAC – AC)

In the denominator, EAC can replace BAC when approved

(BAC – EV) represents the remaining work

(BAC – AC) or (EAC –AC) represents the remaining funds

7.4 Control Costs

Input → **Tools & Techniques** → Output

3. To-Complete Performance Index

Example-1:
Our project has a budget at completion (BAC) is $50,000 and a duration of 12 months. At the end of 6th month, we have earned value (EV) at $20,000, planed value (PV) at $25,000 and actual cost (AC) at $30,000, the formula becomes:

$$TCPI = \frac{BAC - EV}{BAC - AC} = \frac{(50{,}000 - 20{,}000)}{(50{,}000 - 30{,}000)} = \frac{30{,}000}{20{,}000} = 1.5$$

In other words, the team will have to work at an efficiency of $1.50 for every dollar spent to bring the project in on budget from this point forward. It will be hard for the team to do so.... The budget is not enough for the remaining work...

Example-2:
Your analysis determines that the original BAC is no longer achievable, and you should compute the EAC based on the idea that the cost performance will continue (Typical situation).
We compute the new EAC based on the following scenario:
CPI =EV/AC = $20,000/ $30,000 = 0.67
Thus EAC = $30,000 + [($50,000 – $20,000)/ 0.67] = $74,776
With TCPI = (BAC-EV)/ (EAC-AC) we have:

$$TCPI = \frac{BAC - EV}{EAC - AC} = \frac{(50{,}000 - 20{,}000)}{(74{,}776 - 30{,}000)} = \frac{30{,}000}{44{,}776} = 0.67$$

In this case, our new EAC is $24,776 higher than the original BAC. This means the team will have to work at an efficiency of at least $0.67 for every dollar spent to bring the project in on budget from this point forward. This should not be hard for the team to perform.... The budget was adjusted to support the remaining work...

7.4 Control Costs

Considering the Cost Control Results

Cost control is an ongoing process throughout the project. The PM must actively monitor the project for variances to costs.

Specifically, the PM should always do the following:

- Monitor cost variances and then understand why variances have occurred.
- Update the cost baseline as needed based on approved changes.
- Work with the conditions and stakeholders to prevent unnecessary changes to the cost baseline.
- Communicate to the appropriate stakeholders cost changes as they occur.
- Maintain costs within an acceptable and agreed range.

Thank you

Knowledge area

- You can find the whole Project Management Professional course on Z:\eLibraries\eBooks\Management\PMP 6 Course
- You can also visit www.pmi.org for more information

Please call us for any support